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REPORT
RR 183



WINTER ACCIDENT EXPERIENCE IN ONTARIO WITH AND WITHOUT STUDDED TIRES

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MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

Report No. RR183

SUMMARY

Total collision and personal injury accidents on the highways of Ontario during the winter of 1971-72 (without studded tires) are compared with those during the previous winter (with studded tires). Analysis is made, both overall and on a regional basis, against the specific road condition reported at the accident site as well as those generally prevailing. In spite of the general upward trend, summer and winter, in highway accidents, the proportion of accidents on icy or snowpacked and on snowy or slushy roads declined following discontinuance of the use of studded tires.

ABOUT THIS REPORT

This report is part of the study on the use of studded tires undertaken by Engineering Research Branch, Research Division, Ministry of Transportation and Communications Ontario.

The Hon. Gordon Carton Q.C., is the Minister of Transportation and Communications. Mr. A.T.C. McNab is the Deputy Minister of Transportation and Communications.

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MINISTRY OF TRANSPORTATION AND COMMUNICATIONS

WINTER ACCIDENT EXPERIENCE IN ONTARIO
WITH AND WITHOUT STUDDED TIRES

by
P. Smith

For Presentation at the 52nd Annual Meeting
of Highway Research Board, Washington, D.C.

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Winter Accident Experience in Ontario With and Without Studded Tires

INTRODUCTION

The evidence that led to the prohibition of the further use of studded tires in the Province of Ontario after April 30, 1971, has already been documented (1) (2) (3) (4) (5) (6). In brief, this indicated that in addition to serious pavement wear that would be difficult and costly to prevent or repair, other, even more important, factors must be taken into account. The loss of traffic markings, reduction of skid resistance of certain types of surfacings and the presence of worn ruts in the wheel tracks were all considered to be potential hazards to safe driving when the pavements were bare. While performance tests indicated that use of studded tires might be expected to be of benefit when driving on icy surfaces, it was found in fact that icy road conditions only prevailed to a very limited extent. Most importantly, there was no data (though there were lots of claims) that any performance advantages, such as increased traction and maneuverability on ice near the freezing point, equated with actual safety benefits when driving under winter conditions.

In North America, two investigations found no significant effect on winter accidents where studded tires are used (2) (7). A third and fourth study were by no means conclusive, though a slightly lower involvement of cars with studded tires is indicated after appropriate treatment of the data (8) (9). One of these studies (8) has been extended as NCHRP Project 1 13 (1) utilizing data from Michigan as well as Minnesota. Another NCHRP Project 1 13 (2) has been addressed to "Effects of Studded Tires on Highway Safety - Non-Winter Conditions". Neither of these studies has been reported at the time of writing. In Europe, little beyond subjective claims of the type, "with studded tires on all 4 wheels, winter accident rates have not increased in spite of the increase in traffic volume" appear to have been reported.

As succinctly stated by Professor E. Nakkel in his general report for the International Research Symposium on Pavement Wear in Oslo, Norway, in June 1972:

"One fact is indeed remarkable. Nowhere, as yet, has sufficient evidence been established to prove that studded tires in winter road conditions really reduce the risk of accidents. This might be explained by the "risk running behaviour", i.e., a general over-estimation of the degree of safety expected from the use of studded tires, an opinion which, at least in the years before, was strengthened by the tire industry itself through advertising methods motivated by self-interest rather than objectivity."

Against this background the purpose of this paper is to provide a simple comparison of the immediate before-and-after winter accident record in order to try to determine if the highways of Ontario are in fact generally safer or not without the use of studded tires.

The accident data examined is that published by Ministry of Transportation and Communications in the annual "Highway Traffic Collisions in Ontario" as compiled from a uniform style of police report used throughout the Province for all property damage incidents estimated at \$200 or more (\$100 prior to January 1, 1970) and all personal injury or fatal accidents. Additionally, the accidents occurring during the winter months (October to March) of 1970-71 and 1971-72 were abstracted from the general statistics so that each occurrence could be analysed against the road condition reported by the police at the time of their investigation. The data presented on the prevalence of various road conditions over the two winters was obtained in the same manner as for an earlier report (2), from the daily reports (November to April) of the Ministry's highway maintenance patrols.

GENERAL ACCIDENT TREND

Figure 1 illustrates the general trend of total collisions in Ontario for each calendar year from 1966 to the end of 1971.

Even though the increase in vehicle registration and the miles of vehicle travel means that accident rates may actually be lower at the end of the period on certain classes of highways, the fact remains that there is, unfortunately, an increase each year in total collisions. The rate of increase varies only slightly from year to year, though it should be noted that, within this annual variation, 1970 was a "low" year while 1971 was a "high" year.

Table 1, covering the same period (1966-71), shows the distribution of the total collisions in each calendar year in relation to the condition of the road surface on which they occurred. The pattern is strikingly consistent and, specific to this enquiry, it should be noted that over these years in which studded tires came into increasing use, there was no corresponding reduction in the proportion of accidents on icy or snowpacked roads where studded tires were claimed to be of some advantage.

Table 2, which covers the summer and fall/early winter months of 1970 and 1971 in greater detail, indicates that the increase in total collisions and personal injury accidents from the fourth quarter of 1970 to the fourth quarter of 1971 (which was the first winter period when the use of studded tires was not permitted) was of the same order as that between the immediately preceding 3 summer month periods. Preliminary examination of the accident statistics for the spring and summer of 1972 shows that this trend continues unabated.

Against this regrettable background of more accidents every year, a situation which is of course not unique to Ontario, the accident statistics for the period October 1, 1971/March 31, 1972 (the first complete winter without studded tires) may be compared with those for the corresponding period of the previous winter and account taken of differences in the prevailing road conditions from one winter to the next.

WINTER ACCIDENT EXPERIENCE 1971-72 AS COMPARED WITH 1970-71

Two main accident indicators were selected for analysis against the road condition reported at the site of each accident. Total collisions and non-fatal personal injury accidents are used in the analysis, covering the whole of the Province as one unit. In view of the similarity in trends found between the two, only total collisions are analysed in the regional breakdown and when comparing conditions on Provincial Highways with those on all roads. Fatal accidents are not included in the analysis because, fortunately, the small number of these does not provide a statistically valid basis on which to work.

Province-wide Winter Accident Experience

Table 3 compares total collision and personal injury accidents for the winter of 1971-72 (without studded tires) with those occurring over the same period in 1970-71 (with studded tires) for all highways in Ontario. In addition, that fraction of the total collisions which occurred on Provincial highways is shown separately.

In terms of actual numbers, while there was an increase from 85,099 to 99,279 from the winter of 1970-71 to that of 1971-72 in total collisions in the Province, the number of collisions which occurred on icy or snowpacked roads remained almost the same, 22,348 and 22,324. Similarly, for personal injury accidents, while the total increase in these was from 25,845 to 30,727, those which occurred on icy or snowpacked roads only increased from 5,297 to 5,502.

With the magnitude of the overall numbers in mind, it is simpler to talk in terms of percentage increase or decrease in order to place the accidents occurring in various road conditions in perspective.

Considering all highways in the Province, total collisions in icy and packed snow and in snowy or slushy road conditions show a reduction of 0.1 percent and 2.0 percent respectively. These reductions assume greater significance when viewed in light of the 16.7 percent overall increase in total collisions due to the substantial increase in dry and wet road accidents of 21.4 percent and 40.0 percent respectively. The trend is similar with personal injury accidents. Though there was a slight increase in those which occurred in icy and snowpacked road conditions (3.9 percent) and in snowy or slushy conditions (3.7 percent), these increases vary much less than those occurring in dry (19.7 percent) or wet (35.8 percent) conditions, which accounted for almost all of the 18.9 percent overall increase recorded in personal injury accidents.

Thus, provided the winter of 1971-72 was no less severe than its predecessor, especially with respect to the prevalence of icy roads, it appears that the relative incidence of accidents occurring in road conditions where studded tires have been claimed to provide greater safety, in fact declined once studded tires were no longer used.

Regional Winter Accidents Experience

Because of the size of Ontario, the Province-wide experience may be of little solace to a motorist

sliding on ice towards an impact at Red Lake (50.59 N. 93.40 W.) while 1217 miles (1959 KM) by road to the southeast in Toronto (43.42 N. 79.25 W.) the sun is shining on dry pavement. Accordingly, the total collision experience was examined on a regional basis. For this purpose, the Province was divided into 7 areas (following county or other administrative boundaries, which permitted segregation of the accident data from the available records) within each of which generally similar climatic, physiological, economic and road use characteristics occurred. Obviously different splits could be made but most people who know the Province will recognize those chosen as representative of regions, alike within themselves, yet different from each other.

Tables 4 and 5 present this regional data and for ease of display the percent increase or decrease in total collisions for each road condition of interest is indexed against the applicable region in Figure 2. This figure also shows a ranking against each road condition on a scale of 1 to 4 where 1 represents the largest decrease (or smallest increase) and 4 represents the greatest increase in the percentage of accidents occurring on a particular road condition. This ranking system permits a quick grasp of what otherwise would be lengthy explanation of the differences that occurred in accidents between the winter in which studded tires were not permitted and the previous winter.

In three areas, Southwestern, Snowbelt and Urban Counties, bordering on Lake Ontario, there was a significant reduction last winter (without studded tires) in accidents on icy or snowy roads, which ranks these and (1) or (2) (best) on the (1) - (4) scale. This ranking applies also to South Central and Eastern Ontario, though in these areas there was an increase in accidents on icy or snowy roads. In North Central and Northern Ontario the ranking changes, however, so that in both of these areas dry roads become (1) (showing the smallest increase) while ice and snow become (2) and (4) in North Central, and (3) and (2) in Northern Ontario, respectively.

Therefore, in spite of the general increase in collisions, in no case (North or South) did collisions on icy roads show the largest increase, and in most cases accidents in these conditions showed that the greatest decrease or smallest increase. The icy road condition, of course, is the one in which studded snowtires are claimed to provide a safety advantage.

INFLUENCE OF ROAD CONDITIONS

The road conditions likely to be met by a motorist driving on the main highway in Ontario during the winter 1969-70 were assessed in an earlier report (2) on the basis of the number of day/miles when a particular condition prevailed in each of 3 main areas which the data from each of the individual Districts grouped therein indicated had characteristics in

common. Table 6 presents similar data but in summary form for the two succeeding winters, 1970-71 and 1971-72, which are included in this accident study.

Firstly it should be noted that on a Province-wide and regional basis there was an increase in icy road conditions recorded each winter. For example, Province-wide from 1.1 percent in 1969-70 (Ref. 2) to 1.5 percent in 1970-71 to 2.8 percent in 1971-72.

Specific to 1971-72 winter as compared with that of 1970-71, the regional road condition data is displayed in Figure 3 in terms of the nearest whole percent increase or decrease in each condition. This shows that in the Southern Tier the increase in icy road conditions was of the order of 25 percent, while in both the Middle and Northern Tiers the increase was 100 percent. Looking back at Figure 2 (displaying the percent increase or decrease in total collisions) a rough comparison can be made against the increase or decrease in icy road accidents even though the "accident" regional areas do not follow the same boundaries. Generally in the South the 25 percent increase in icy road conditions was not matched by a corresponding increase in icy road accidents among the vehicles exposed to travelling in these conditions. Indeed, in three of the southern accident areas there was actually a decrease in icy-road accidents. Turning to the Middle and Northern Tier road conditions which cover the North Central and Northern accident areas, the increase in icy road accidents in these areas of plus 8 percent and plus 53 percent respectively is much less than the 100 percent increase in icy road conditions that prevailed in both.

The other significant differences between the two winters appear to be that in the south there was less snowy or slushy and less wet pavement, while in the Middle Tier there was an increase in snowy or slushy and in wet pavement.

Ontario motorists have enjoyed a high standard of winter road maintenance through the optimum combination of plowing, sanding and salting appropriate to particular weather, road and traffic conditions.

The data for the analysis of road conditions was gathered only from roads maintained by the Province and the corresponding data is not available for roads under municipal jurisdiction which may have different, and, probably in rural areas or on side streets in towns somewhat, lower standards of winter maintenance. Province-wide, about one third of the total collisions on icy roads occurred on Provincial highways and the decrease in this case in 1971-72 winter from the previous year was 4.4 percent as compared with only 0.1 percent when all highways were taken into account.

This observation and such findings as those reported on the dramatic reductions in stopping distances

which occur irrespective of the type of tire, once ice at higher temperatures is sanded (5), suggest that a more detailed examination of the relative influence of weather conditions, maintenance practices, natural clearing and resulting road conditions, Provincial or municipal, rural or urban on the winter accident picture would be worth undertaking.

This possibility is being examined, but at present there is a lack of detailed and comparable data that appears to preclude a full rationalization of winter maintenance standards on the basis of accident or economic considerations. Pending this, caution must be exercised to ensure that the level of service achieved by present standards of winter road maintenance is not allowed to decline in face of increasing costs and because of pressures to reduce pollution from spent road salting.

CONCLUDING REMARKS

The analysis of accidents and road conditions presented in this report of necessity paints a broad picture across the whole of the winter and across the whole of the Province or regions thereof. In so doing, while this may not relate to a particular community, rural or urban, or to a particular freeway or back road or to the experiences of an individual driver, it does appear to answer beyond reasonable doubt the question "Are the highways of Ontario in general safer or not in winter without the use of studded tires?"

In face of the continuing trend of increasing highway accidents, summer and winter alike, the proportion of winter accidents occurring on icy roads declined in the first winter following prohibition of the use of studded tires. Considering the prevalence of icy road conditions, this relative decline occurred in all regions of the Province, North and South.

Naturally there is cause for grave concern in the number and continuing increase in accidents in circumstances, such as on dry or wet roads in summer and winter alike, where cessation of the use of studded tires cannot have had a direct influence. Research and countermeasure efforts are being addressed to this problem. Studies of the circumstances of winter (and summer) accidents on particular highways, in specific localized areas and time periods might throw light on a common cause(s). Equally, past experience of accident causation studies indicates that the results might well be inconclusive because of the nature of the data available, the number of unknowns and vast range of interacting variables. Such an investigation would have to taken into account not only local variations in road and weather conditions, in traffic volumes and in driver/vehicle operating characteristics, but also continuing highway serviceability deficiencies, such as the reduction in skid resistance of certain types of pavement surface and the consequences of

wheel track wear rutting caused during the period when studded tires were in use (2) (6).

It would be of interest to know why the physical performance promise of studded tires in reducing stopping distances, improving traction and maneuverability on icy surfaces at temperatures above 0 degree F (-18C), which is indicated by controlled tests is not apparently translated into tangible improvements in safety in actual driving circumstances on icy highways. While there are physical differences between tests on smooth ice and actual driving in traffic on road ice seemingly other, non-physical, factors govern. It may prove both difficult and pointless to try to determine if people who did not have to drive stayed home on bad days or if those who had to drive drove more slowly or more cautiously and hence took fewer risks without studded tires, and what the social and commercial consequences of such actions were.

Whatever the answer on these points may be, there is a real need for winter driving aids that provide both the convenience of increased traction and the assurance of better vehicle control in adverse conditions. If the present level of mobility and favourable accident experience is to be maintained it would be imprudent to reduce levels of winter maintenance in response to financial or pollution constraints at least until such winter driving aids are available and proven effective.

As pointed out as the final conclusion of the very first report on the studded tire investigation in Ontario, research and development work on alternative winter driving aids is the one of most potential benefit. (1) Since then, a promising start has been reported in devising and performance testing of alternatives to the conventional studded snow tire (5) (10). Many other ideas and products are in the initial stages of development or evaluation by their manufacturers, and an NCHRP Project for "Evaluation of Winter Driving Traction Aids" is being developed. It is hoped that the findings of this report will spur such efforts rather than the continuance of post mortems on conventional studded tire performance or the mitigation of the adverse effects of their use.

ACKNOWLEDGEMENTS

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**Table 1, Distribution of Total Collisions by Road
Condition For Each Year From 1966/71**

ROAD SURFACE CONDITION	CALENDAR YEAR BY PERCENTAGE					
	1966	1967	1968	1969	1970	1971
DRY	56.5	55.0	57.8	60.4	55.5	53.8
WET	25.6	25.5	22.1	22.1	24.0	22.2
SNOW AND SLUSH	6.2	6.7	6.2	5.6	8.3	8.2
ICE AND PACKED SNOW	10.4	11.5	12.6	10.8	11.1	14.4
OTHER ⁽¹⁾	1.3	1.3	1.3	1.2	1.1	1.4

NOTE: (1) OTHER INCLUDES MUD, LOOSE SAND OR GRAVEL ETC.

**Table 2, Total Collisions and Personal Injury Accidents
Summer and Fall/Early Winter Months of 1970 and 1971**

MONTH	TOTAL COLLISIONS		PERCENT INCREASE 1971 OVER 1970	PERSONAL INJURY ACCIDENTS		PERCENT INCREASE 1971 OVER 1970
	1970	1971		1970	1971	
JULY	11,704	13,105	+11.97	4,670	5,513	+18.05
AUGUST	10,985	12,936	+17.76	4,574	5,340	+16.75
SEPTEMBER	11,388	12,281	+ 7.84	4,538	5,077	+11.88
OCTOBER	12,853	14,699	+14.36	4,827	5,703	+18.15
NOVEMBER	12,545	16,347	+30.31	4,409	5,409	+22.68
DECEMBER	17,585	18,126	+ 3.08	5,014	5,681	+13.30

**Table 3, Total Collisions and Personal Injury Accidents
By Road Surface Condition
For the Winters 1970/71 and 1971/72**

ROAD SURFACE CONDITION	ALL HIGHWAYS IN ONTARIO						PROVINCIAL HIGHWAYS ONLY ⁽²⁾		
	TOTAL COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	PERSONAL INJURY ACCIDENTS WINTER		PERCENT INCREASE 71/72 OVER 70/71	TOTAL COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71
	1970/71	1971/72		1970/71	1971/72		1970/71	1971/72	
DRY	26,948	32,716	21.4	9,757	11,677	19.7	5,287	5,948	12.5
WET	20,950	29,339	40.0	7,157	9,718	35.8	3,289	3,902	18.6
SNOW AND SLUSH	14,245	13,958	- 2.0	3,427	3,554	3.7	2,942	3,395	15.4
ICE AND PACKED SNOW	22,348	22,324	- 0.1	5,297	5,502	3.9	5,998	5,732	- 4.4
OTHER ⁽¹⁾	608	942	55.0	207	276	33.3	46	56	21.7
TOTAL	85,099	99,279	16.7	25,845	30,727	18.9	17,562	19,035	8.4

NOTE: (1) OTHER INCLUDES MUD, LOOSE SAND AND GRAVEL ETC.

(2) PROVINCIAL HIGHWAYS ARE THOSE MAINTAINED BY THE PROVINCE OF ONTARIO AND EXCLUDES ROADS AND STREETS UNDER MUNICIPAL JURISDICTION.

**Table 4, Total Collisions in South-Western Snow Belt,
Urban Counties Bordering Lake Ontario and South Central Ontario,
By Road Surface Condition for the Winters 1970/71 and 1971/72**

ROAD SURFACE CONDITION	SOUTH WESTERN ⁽²⁾			SNOW BELT ⁽³⁾			URBAN COUNTIES BORDERING LAKE ONTARIO ⁽⁴⁾			SOUTH CENTRAL ⁽⁵⁾		
	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71
	1970/71	1971/72		1970/71	1971/72		1970/71	1971/72		1970/71	1971/72	
DRY	4,382	5,350	22.1	1,679	2,222	32.3	14,032	17,522	24.9	1,893	2,295	21.2
WET	3,024	3,935	30.1	1,437	2,036	41.7	11,414	16,175	41.7	1,513	1,965	29.9
SNOW AND SLUSH	1,561	1,442	- 7.6	1,625	1,343	-17.4	5,646	5,591	- 1.0	1,199	1,343	12.0
ICE AND PACKED SNOW	3,117	2,428	-22.1	2,888	2,508	-13.2	7,256	6,714	- 7.5	2,724	2,834	4.0
OTHER ⁽¹⁾	126	190	50.8	62	98	58.1	232	355	53.0	61	82	34.4
TOTAL	12,210	13,345	9.3	7,691	8,207	6.7	38,580	46,357	20.2	7,390	8,519	15.3

NOTE: (1) OTHER: MUD, LOOSE SAND OR GRAVEL ETC.
(2) INCLUDES THE FOLLOWING COUNTIES: BRANT, ELGIN, ESSEX, HALDIMAND, KENT, LAMBTON, MIDDLESEX, NORFOLK, OXFORD
(3) INCLUDES THE FOLLOWING COUNTIES: BRUCE, DUFFERIN, GREY, HURON, PERTH, WATERLOO, WELLINGTON
(4) INCLUDES THE FOLLOWING COUNTIES: HALTON, LINCOLN, ONTARIO, PEEL, WELLAND, WENTWORTH, YORK
(5) INCLUDES THE FOLLOWING COUNTIES: DURHAM, FRONTENAC, HASTINGS, LENNOX AND ADDINGTON, NORTHUMBERLAND, PETERBOROUGH, PRINCE EDWARD, SIMCOE, VICTORIA

**Table 5, Total Collisions in Eastern, North Central and Northern Ontario
By Road Surface Condition For the Winters 1970/71 and 1971/72**

ROAD SURFACE CONTION	EASTERN ⁽²⁾			NORTH CENTRAL ⁽³⁾			NORTHERN ⁽⁴⁾		
	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71	COLLISIONS WINTER		PERCENT INCREASE 71/72 OVER 70/71
	1970/71	1971/72		1970/71	1971/72		1970/71	1971/72	
DRY	2,252	2,813	24.9	1,969	1,707	- 13.3	741	807	8.9
WET	1,991	2,940	47.7	1,242	1,675	34.9	329	613	86.3
SNOW AND SLUSH	2,772	2,371	-14.5	908	1,259	38.7	534	611	14.4
ICE AND PACKED SNOW	2,849	3,510	23.2	2,310	2,485	7.6	1,204	1,843	53.1
OTHER ⁽¹⁾	56	74	32.1	55	104	89.1	16	39	143.8
TOTAL	9,920	11,708	18.0	6,484	7,230	11.5	2,824	3,913	38.6

NOTE: (1) OTHER: MUD, LOOSE SAND OR GRAVEL ETC.
(2) INCLUDES THE FOLLOWING COUNTIES: CARLETON, DUNDAS, GLENGARRY, GRENVILLE, LANARK, LEEDS, PRESCOTT, RENFREW, RUSSELL, STORMONT.
(3) INCLUDES THE FOLLOWING DISTRICTS: HALIBURTON, MANITOULIN, MUSKOKA, NIPPISING, PARRY SOUND, SUDBURY, TIMISKAMING.
(4) INCLUDES THE FOLLOWING DISTRICTS: COCHRANE, KENORA, RAINY RIVER, THUNDER BAY.

**Table 6, Winter Road Conditions in Ontario
1970/71 and 1971/72**

AREA ⁽¹⁾	PROVINCIAL ⁽²⁾ HIGHWAYS TOTAL MILES	WINTER ROAD CONDITIONS							
		BARE DRY PERCENT		BARE WET PERCENT		SNOW OR SLUSH PERCENT		ICY PERCENT	
		1970/71	1971/72	1970/71	1971/72	1970/71	1971/72	1970/71	1971/72
SOUTHERN TIER	6,547	48.9	56.1	33.1	30.3	17.2	12.6	0.8	1.0
MIDDLE TIER	3,563	42.3	31.0	26.7	33.4	30.2	34.0	0.8	1.6
NORTHERN TIER	4,882	27.0	27.7	30.0	27.3	40.0	39.0	3.0	6.0
TOTAL	14,992	39.4	40.6	29.9	30.0	29.2	26.6	1.5	2.8

NOTE: (1) SOUTHERN TIER - CHATHAM, LONDON, STRATFORD, HAMILTON, TORONTO, PORT HOPE, KINGSTON, OTTAWA, M.T.C. DISTRICTS
MIDDLE TIER - OWEN SOUND, BANCROFT, HUNTSVILLE, NORTH BAY, SUDBURY, M.T.C. DISTRICTS
NORTHERN TIER - NEW LISKEARD, COCHRANE, SAULT STE. MARIE, THUNDER BAY, KENORA, M.T.C. DISTRICTS
(2) PROVINCIAL HIGHWAYS - ARE THOSE HIGHWAYS MAINTAINED BY PROVINCE OF ONTARIO AND EXCLUDES ROADS AND STREETS UNDER MUNICIPAL JURISDICTION. MILEAGES SHOWN ARE IN ORDER, 10,536, 5,734, 7,857, 24,127, KILOMETERS.

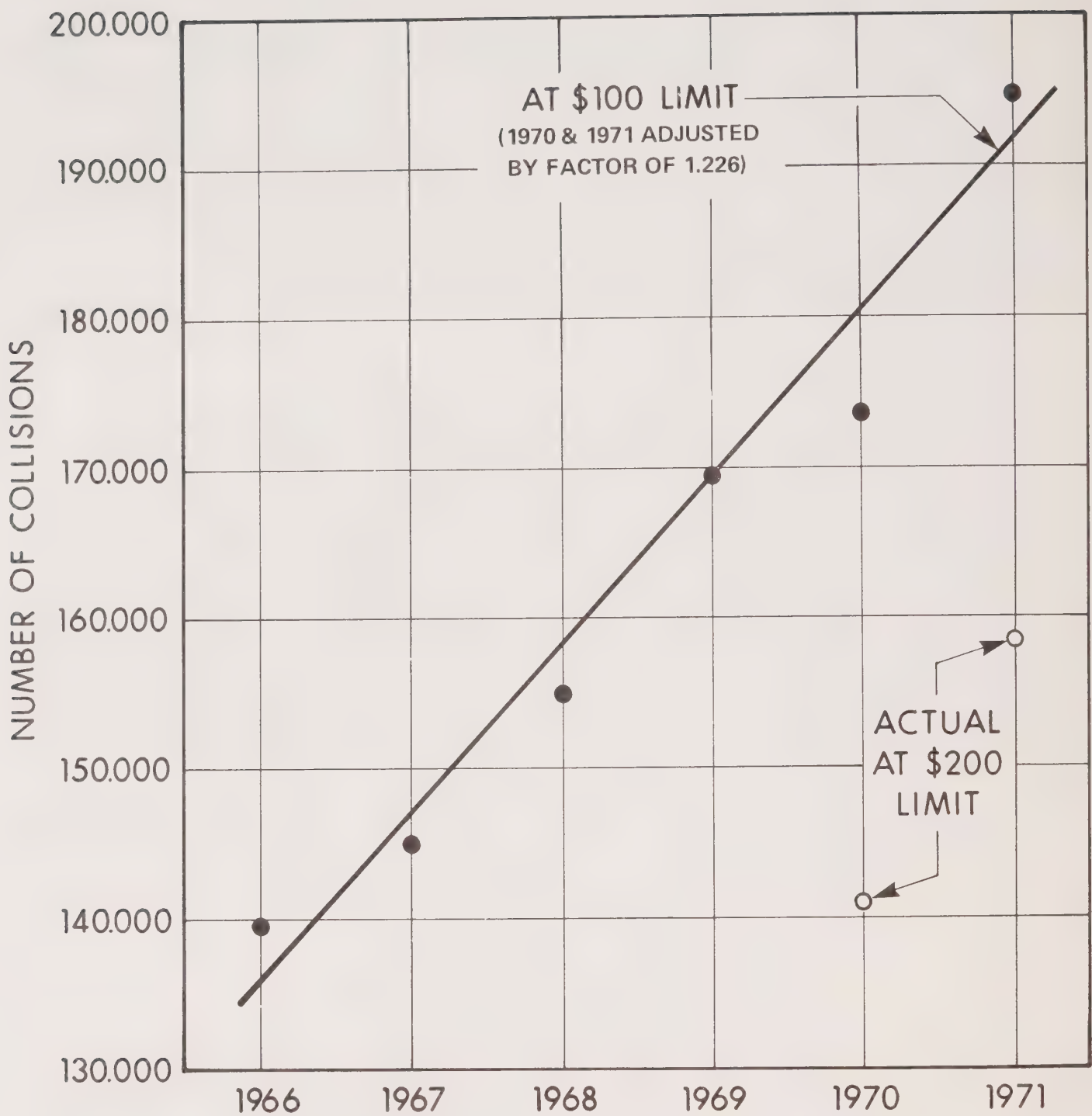


FIGURE 1, TREND IN TOTAL COLLISIONS
1966 TO 1971

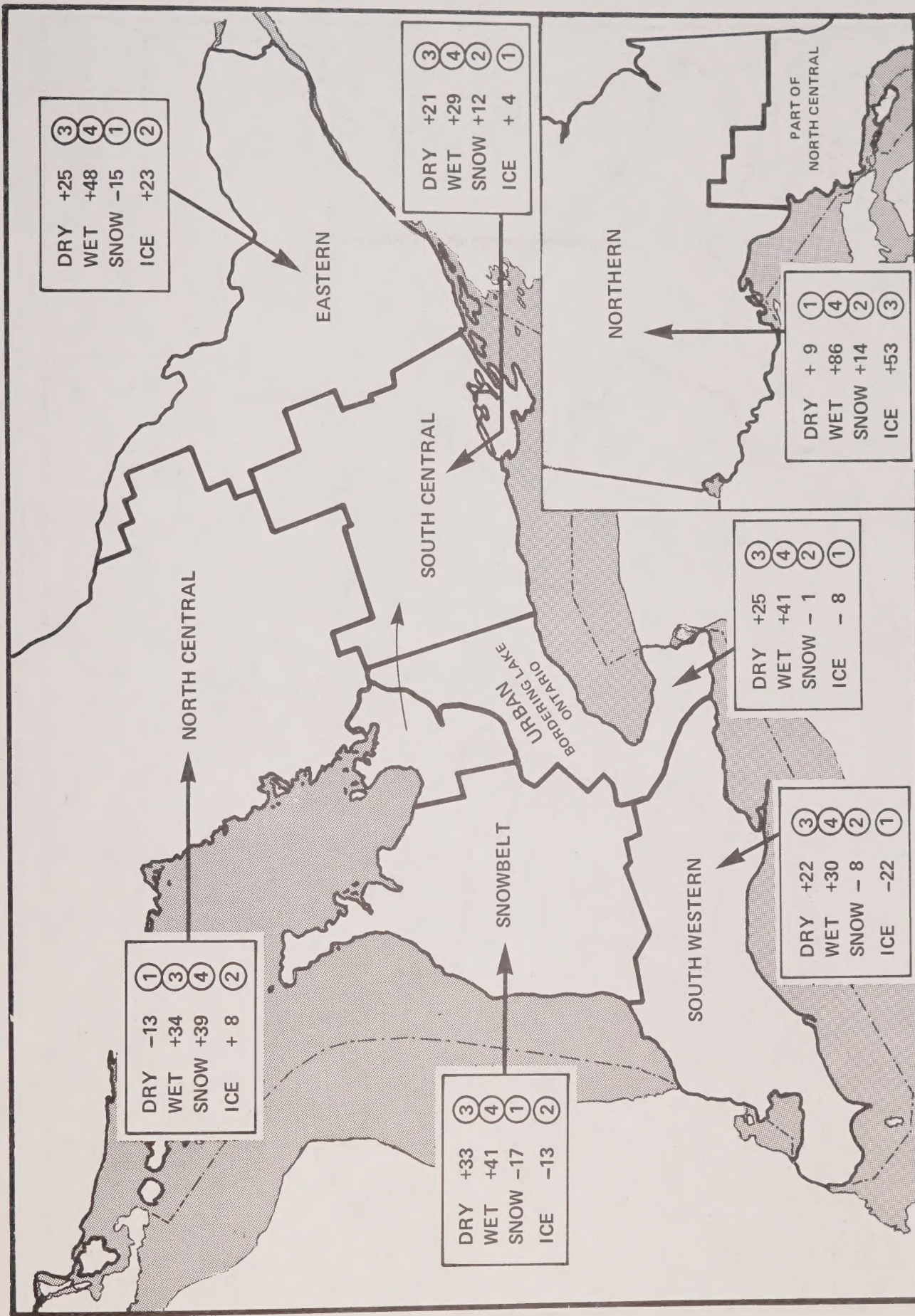


FIGURE 2, PERCENTAGE INCREASE (+) OR DECREASE (-) IN TOTAL COLLISIONS
BY ROAD CONDITIONS AND REGIONS OF ONTARIO
WINTER 1971-72 OVER 1970-71

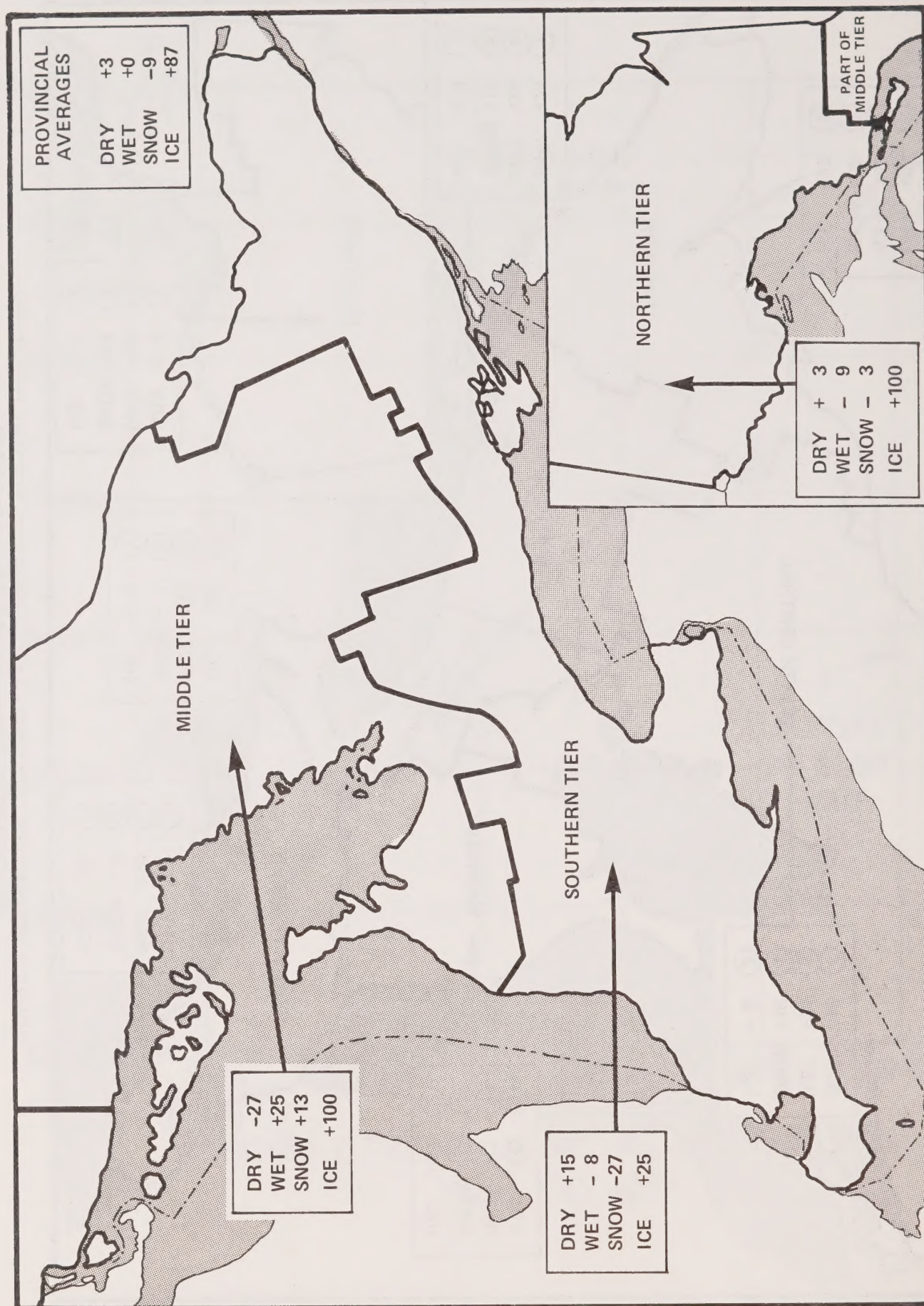


FIGURE 3, PERCENTAGE INCREASE (+) OR DECREASE (-)
IN REPORTED ROAD CONDITIONS
WINTER 1971-72 OVER 1970-71

